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COMPLETE SPECIFICATION

Method for Producing Etched Printed Circuits on Metal Foils

We BLAUPUNKT-WERKE GMBH. a German Company, of 200, Robert-Bosch-Strasse, Hildesheim, Germany, do hereby declare the invention, for which we pray that a patent

5 which it is to be performed, to be particularly described in and by the following statement:—

10 The invention relates to a method for producing printed circuits on metal foils, and more particularly of copper, using an acid etching agent, wherein the surfaces not to be etched are protected by an acid proof varnish.

15 In the manufacture of so-called printed circuits by etching, a carrier material, laminated with a copper foil is imprinted with the appropriate circuit pattern by means of an acid-proof varnish, and the free portions are removed in suitable baths by means

20 of an acid reaction. The circuit pattern is printed preferably by a screen-printing process, requiring particularly consistent printing inks produced by adding thickening agents, fillers and colouring substances. The varnishing resins used are usually acid-proof, water-proof and unsaponifiable resins, such as cumarone resins.

30 After the etching, the acid-proof coating is usually removed by an organic varnish solvent, such as xylene, benzene or preferably trichloroethylene, using special suitable washing apparatus. Before washing the plates in this apparatus, they must be dried after etching and rinsing.

35 The manufacture of so-called printed circuits which are mass produced, requires, as far as possible, an automatic continuous process, eliminating the individual processing of the parts, wherein all processing stages comprise simple chemical dipping.

40 According to the invention, this may be achieved if the acid-proof varnish coating is soluble in an alkaline solvent using as covering

varnish varnishing resins soluble in alkalis or otherwise removable by alkalis, and more particularly phenol-Novolak, colophonium, natural shellac, maleinate resins or alkyd resins, the varnish being removed after etching, to print electrical connections to be made, by means of an alkaline solution.

According to the invention it is also an advantage if the covering varnish containing a filler improving its consistency, and a dye for rendering the varnish visible, contains, particularly for use in so-called screen-printing processes, and acid-proof alkali-soluble filler and dye. These fillers and dyes may be present in highly dispersed form and consist preferably of silicic acid and Prussian blue.

The alkaline solvent may be an aqueous alkali, such as caustic soda with a concentration down to 1%.

According to a further feature of the method of the invention, using a covering varnish characterized by its solubility in alkalis, the continuous wet treatment of the printed circuit in a continuous installation, such as is used in galvanizing, is possible, without requiring intermediate drying and the use of expensive or dangerous solvents. The use of conventional solvents required hitherto in most cases the use of expensive apparatus and a mechanical or manually operated final cleaning for each printed circuit in order to ensure sufficient cleanliness. The varnish according to the invention is removed without residue simply by dipping for one to two minutes in a 1—2% soda lye at room temperature.

Since the fillers and dyes are also easily decomposed and dispersed in the alkaline bath, the final cleaning of the printed circuit may then be effected by simple dipping in suitable solutions, and the manufacture is terminated by a simple drying, the so-called final drying.

A particular process according to the inven-

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tion for the preparation of etched patterns on metal foils will now be described by way of Example.

- 5 The metal foil—in the case of so-called printed circuits copper foils on hard paper—is first printed with the acid proof, but alkali soluble printing ink in the form of the desired pattern. As method of printing, the so-called screen printing is concerned. The printing ink
- 10 concerned has the following composition:
- 4 kg Novolak (Phenol-Novolak 429 K der Firma Chemische Werke Albert, Wiesbaden,
 - 15 70 g Aerosil (highly dispersed silicic acid) of Firma Degussa, Frankfurt/Main
 - 20 g Prussion Blue.
 - 2 litre acetophenone.
 - 3 litre lactonal (Lactic acid ethyl ester)
 - 10 ccm Silicone oil solution 1:50
- 20 These substances are stirred in a stirring apparatus until they dissolve, and rubbed on a colour mill until they are homogeneous. The ink is then ready for printing.
- 25 The pattern printed with this ink is then dried in the air or at a maximum of +80° C. in the oven and can then be etched in etching baths of iron chloride or copper chloride. The printing ink is also stable to acid reaction even with long exposure. Upon the conclusion of the etching, the etched parts are rinsed
- 30 in water and can then be placed in a wet condition, for removing the acid protecting colour, directly into an ink removing bath consisting of 10 litres of water and 2 kg
- 35 sodium hydroxide.
- The bath is operated at room temperature and the complete dissolution of the printing ink occurs in the bath in 1 to 2 minutes on account of its alkali solubility.
- 40 The clean parts are then rinsed again and can thereafter be etched bare, if desired, washed once again and dried. The said solution bath for removing the printing ink can be set up at very low costs and it is very economical. The ink-removing bath is exhausted
- 45 when about 2 kg of ink (weight of dried ink) are dissolved and must then be replaced by a new solution of dilute sodium hydroxide.

Exhaustion of the solution can be recognised by the time required for dissolving the ink rising to 3 to 4 minutes. The described etching, cleaning and rinsing processes can be advantageously carried out in a continuously operating installation such as for example in an automatic electrolytic apparatus.

WHAT WE CLAIM IS:—

1. A method for producing etched patterns on metal foils, and more particularly printed circuits, by means of an acid etching agent, wherein the surfaces not to be etched away are protected by an acid-proof covering varnish, and after etching the acid-proof covering varnish is removed, to permit electrical connections to be made, by means of an alkaline solution.
2. A method as claimed in claim 1, in which the covering varnish, particularly for use in so-called screen printing, contains a filler increasing its body and a dye rendering it visible, the filler and the dye being acid-proof and soluble in alkalis.
3. A method as claimed in claim 1, in which the varnish is phenol-Novolak, colophonium, natural shellac, a maleinate resin or an alkyd resin.
4. A method as claimed in claim 2, in which the filler and dye are present in the varnish in a highly dispersed form.
5. A method as claimed in claim 4 in which the filler and dye are silicic acid and Prussian blue.
6. A method as claimed in any one of the preceding claims in which the alkaline solution is an aqueous alkali of 1% to 2% concentration by weight.
7. A method as claimed in any one of the preceding claims, in which the manufacture of the printed circuits from the etching, including removal of the varnish and subsequent cleaning, is effected without intermediate drying.

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